DOCUMENT RESUME

ED 091 237 SE 017 930

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TITLE Development of a Science Teaching Opinion Survey for Use with Pre-Service and In-Service Science Teachers.
PUB DATE Apr 74
NOTE 11p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (47th, Chicago, Illinois, April 1974)

EDRS PRICE MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS *Educational Research; *Evaluation; Inservice Teacher Education; *Measurement Instruments; *Opinions; Preservice Education; Science Education; Science Teachers; *Teacher Education
IDENTIFIERS Research Reports; *Science Teaching Opinion Survey

ABSTRACT

Reported is the development of an experimental instrument for use in monitoring opinions of preservice and inservice science teachers concerning science teaching. Also reported is a study in which this instrument was used. The instrument, The Science Teaching Opinion Survey, consists of 20 statements to which respondents react via a five point scale ranging from "strongly agree" to "strongly disagree." (A copy of the instrument is included in this report.) Use of the instrument with preservice teachers enrolled in a science methods course and with inservice teachers attending NSF institute programs appears to indicate that it is sensitive, reliable, and easy to score. It requires a minimum of time to administer and lends itself readily to statistical analysis. (Author/PEB)

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ED 091237

DEVELOPMENT OF A SCIENCE TEACHING OPINION SURVEY FOR USE WITH PRE-SERVICE AND IN-SERVICE SCIENCE TEACHERS

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Introduction

Pre-service and inservice science teachers possess various opinions concerning science teaching based on experiences they have had. These opinions become an important factor when planning instructional activities and workshops for these teachers and thus need to be assessed. Several techniques have already been developed to measure teacher attitudes and reactions to various situations. Observational techniques, personal interviews, rating scales, questionnaires, and other schemes can provide meaningful data. There are advantages and disadvantages for each of these techniques with one being better suited to a given situation than another.

If pretest and posttest as well as control group and experimental group comparisons are to be made for a given program, it is advantageous to employ an instrument which lends itself readily to common statistical treatments. The Likert-type rating scale is well suited for this purpose. It consists of a five-point scale in which the interval between each point on the scale is assumed to be equal. The scale is used to register the subject's extent of agreement or disagreement with a particular statement of an attitude, belief, or judgment. The person completing the scale marks one answer category, usually, strongly agree, agree, undecided, disagree, or strongly disagree. These responses are valued 5, 4, 3, 2, 1, respectively, with 5 assigned to the response which, if marked, would indicate a judgment favorable to the program or situation being assessed. Each statement can thus be scored and a total score can be derived for the entire scale. Since

analysis of data from Likert-type scales are usually based on summated scores over a number of items, the equal-interval assumption is workable (1). The usual statistical techniques can then be applied to these scores.

This paper describes the development of an experimental instrument for use in monitoring opinions of pre-service and in-service science teachers concerning science teaching. In addition, an experimental study making use of the instrument is also reported.

The Science Teaching Opinion Survey

This instrument was initially developed to provide feedback information concerning opinions about science teaching expressed by pre-service science teachers enrolled in a science methods course. Thirty-five statements were constructed to reflect current thinking about teaching methodologies and curriculum developments at the secondary school level. For the most part the statements were designed to place emphasis on science teaching as it relates to the investigative nature of science and the related processes. The original thirty-five statements were then presented to 24 science supervisors and seven science educators for refinement. In addition, these persons were asked to indicate if they felt the statements were in agreement with current thinking about science teaching.

The total pool of 35 items was then administered to 84 in-service science teachers in a pilot test. The responses given by the teachers to each individual item were correlated with the total scores obtained by the teachers on the entire scale. This item analysis procedure provides an indication of the degree of agreement or overlap between each individual item and the total scale, that is, the extent to which each item measures what the total scale measures. The purpose of this procedure was to identify

those statements which best agree with the scale and will thus yield the greatest degree of internal consistency. Using this procedure it was possible to identify 20 statements showing the greatest amount of agreement with the total score. Correlations for the 20 statements selected are shown in Table I. The final version of the instrument is shown at the end of this paper.

-- INSERT TABLE I HERE

In examining the instrument, it will be seen that some of the statements have been reversed so that the desirable response is not strongly agree but strongly disagree. These negative statements are scored in reverse with five points assigned to the strongly disagree response. The final instrument will thus yield a maximum score of 100 points (5 x 20) and a minimum score of 20 points (1 x 20). A neutral score would appear to be 60 points but it may not be neutral in reality (2). It is possible for a score of 60 to be obtained by a respondent without ever marking a single one of the middle positions (Undecided).

Experimental Results

The instrument was administered to two science methods classes at the University of Maryland on a pretest and posttest basis during the 1972-73 school year. The science methods course is 16 weeks in length and students are student-teaching simultaneously. An analysis of variance between pretest and posttest scores is shown in Table II (3). There is a significant difference in the way students respond to the instrument on a pretest and posttest basis. Since the posttest mean is higher, it would indicate that students have moved

to a position more in favor of current teaching and curriculum philosophy as measured by this instrument.

-- INSERT TABLE II HERE

The instrument was also administered to a group of in-service teachers attending institute programs at the University of Maryland during the 1972-73 school year. These results were compared with the pretest and posttest results of pre-service teachers. These results are summarized in Table III.

-- INSERT TABLE III HERE

As can be seen from the table, pre-service teachers show a gain in means on all but four items in the pretest and posttest results. The pre-service teacher has a somewhat lower initial total score when compared with the in-service teacher but the mean pre-service posttest score is higher than the mean in-service score. An item by item analysis could yield further information.

Conclusions

This study was designed to develop a readily usuable survey instrument for assessing opinions concerning science teaching with pre-service and in-service teachers. It appears that the instrument designed shows evidence of being sensitive and reliable. It is inexpensive, requires a minimum of time to administer, is easy to score, and lends itself readily to statistical analysis. A similar instrument could be developed for use with the teacher's students in which the student would indicate teaching practices by the teacher. Correlations between scores of teachers and students could then be made. This would yield information not only about opinions concerning science teaching by a teacher but about teaching practices as well.

Science Teaching Opinion Survey

Directions: This inventory consists of 20 statements designed to sample your opinions concerning science teaching. Read each statement carefully and decide how you feel about it. Circle your choice corresponding to the following:

SA: Strongly Agree A: Agree U: Undecided D: Disagree SD: Strongly Disagree

*SA	A	U	D	SD	1. Science students should be provided class time for exchanging ideas about science among themselves.
SA	A	U	D	SD	2. Questions by teachers requiring yes and no responses are particularly useful in science teaching.
SA	A	U	D	SD	3. The science course should be organized so that students are told exactly how and what they are expected to do.
*SA	A	U	D	SD	4. The laboratory should be the center for instruction in the sciences.
SA	A	U	D	SD	5. A serious effort should be made to complete the textbook or course syllabus for a science course.
SA	A	U	D	SD	6. Well prepared lectures are efficient and effective for most science topics.
SA	A	U	D	SD	7. Scientific facts and definitions should provide the core of a science course.
*SA	A	U	D	SD	8. A well stated question by a student is as important as a well stated answer by a student.
*SA	A	U	D	SD	9. Science courses should be developed which make use of multiple references rather than a single textbook.
SA	A	U	D	SD	10. Science teachers should have in mind specific answers to questions they pose in a teaching situation.
SA	A	U	D	SD	11. The laboratory should be used to repeat and verify experiments that students have read about.
*SA	A	U	D	SD	12. Some time in the science course should be used for examining the original work of scientists in the original format.
*SA	A	U	D	SD	13. Major examinations in science courses should be designed to concentrate on knowledge gained from the laboratory.
SA	A	U	D	SD	14. For continuity, science courses should be developed to employ a single teaching strategy or method.
*SA	A	U	D	SD	15. Teachers should minimize "telling" and maximize "questioning" in teaching science courses.
*SA	A	U	D	SD	16. Laboratory investigations should be used to introduce most science topics.
SA	A	U	D	SD	17. Science students should be required to learn the steps in the scientific method at the beginning of the course.

SA A U D SD 18. Laboratory studies should consist of laboratory guides providing step-by-step directions.

SA A U D SD 19. Considerable class time should be spent in reviewing material students have been assigned to read.

*SA A U D SD 20. An attempt should be made to carry out laboratory investigations suggested by students even though not originally planned for the cource.

*Positive Statements, SA = 5, SD = 1

References

1. Tuckman, Bruce W. Conducting Educational Research. New York: Harcourt Brace Jovanovich, Inc., 1972.

2. Edwards, Allen L. Techniques of Attitude Scale Construction. New York: Appleton-Century-Crofts, Inc., 1957.

3. Ferguson, George A. Statistical Analysis in Psychology and Education. New York: McGraw-Hill Book Company, 1966.

Table I

Correlations Between Item Scores and Total Score For Pilot Test

Item	Correlation	Item	Correlation
1	.42	11	.50
2	.46	12	.17*
3	.43	13	.43
4	.40	14	.36
5	.42	15	.58
6	.48	16	.41
7	.62	17	.37
8	.45	18	.37
9	.42	19	.43
10	.38	20	.40

*Not Significant, .05 level, N = 84

Table II

Analysis of Variance for Pretest and Posttest Scores

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F-Ratio
Between	1	292.32	292.32	5.14*
Within	76	4318.56	56.82	
Total	77	4610.88		

*Significant at .05 level, N = 39

Table III

Item Mean Scores and Total Mean Scores for Pre-Service and In-Service Teachers

Item	Pre-Service Pretest N = 39	Pre-Service Posttest N = 39	In-Service N = 71
1	4.36	4.31	3.92
2	4.03	4.33*	4.10
3	3.46	3.28	2.79
4	3.97	4.36*	4.31
5	3.67	3.67	3.79
6	3.03	3.13*	2.93
7	3.31	4.05*	3.76
8	4.33	4.59*	4.48
9	4.31	4.38*	4.14
10	3.33	3.56*	3.2-
11	3.10	3.28*	3.30
12	3.38	3.33	3.10
13	3.36	3.56*	3.30
14	4.00	4.49*	4.37
15	4.21	4.41*	4.04
16	3.64	3.92*	3.89
17	2.72	2.77*	3.44
18	2.54	3.03*	2.86
19	3.46	3.72*	3.55
20	4.00	4.10*	4.00
Total	72.10	75.97	73.63

*Gain over pretest mean